



Sarcopenia, long term care and nutritional implications

Paul Rigby
Medical Affairs Manager
Mobility / Elderly Care Category
Nutricia Advanced Medical Nutrition



Overview

- Sarcopenia definition
- Decline in muscle mass and strength with age
- Prevalence of sarcopenia
- Consequences of sarcopenia
- Management of sarcopenia
 - Nutritional management of sarcopenia
Protein, EAA / leucine, vitamin D

Sarcopenia: Educational resources

CME accredited e-learning tool for clinicians

“Managing Sarcopenia, Improving Physical Decline”
Prof Yves Rolland

Developed by The International Association of Gerontology and Geriatrics (IAGG) in association with the Journal of Nutrition and Healthy Aging

Covering sarcopenia from definition, epidemiology and consequences to diagnosis, etiology and management therapies

www.jnha-elearning.org

Sarcopenia: Operational definition

REPORT

Sarcopenia: European consensus on definition and diagnosis

Report of the European Working Group on Sarcopenia in Older People
ALFONSO J. CRUZ-JENTOFT¹, JEAN PIERRE BAEYENS², JÜRGEN M. BAUER³, YVES BOIRIE⁴,
TOMMY CEDERHOLM⁵, FRANCESCO LANDI⁶, FINBARR C. MARTIN⁷, JEAN-PIERRE MICHEL⁸,
YVES ROLLAND⁹, STÉPHANE M. SCHNEIDER¹⁰, EVA TOPINKOVÁ¹¹, MAURITS VANDEWOUDE¹²,
MAURO ZAMBONI¹³

Sarcopenia:

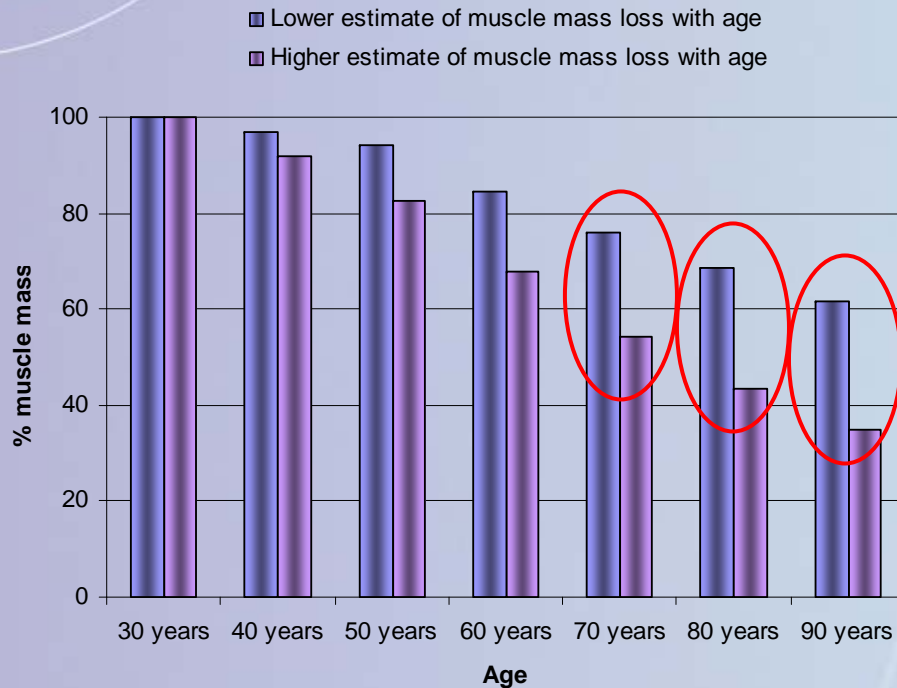
*The age related decline in
muscle mass, strength and function*

Stage	Muscle mass	Muscle strength	Performance
Pre-sarcopenia	↓		
Sarcopenia	↓	↓	or ↓
Severe sarcopenia	↓	↓	& ↓

The decline in muscle mass and strength with increasing age

Muscle mass

After 30 years of age: 3-8% decline per decade
 After 50 years of age: 10-20% decline per decade



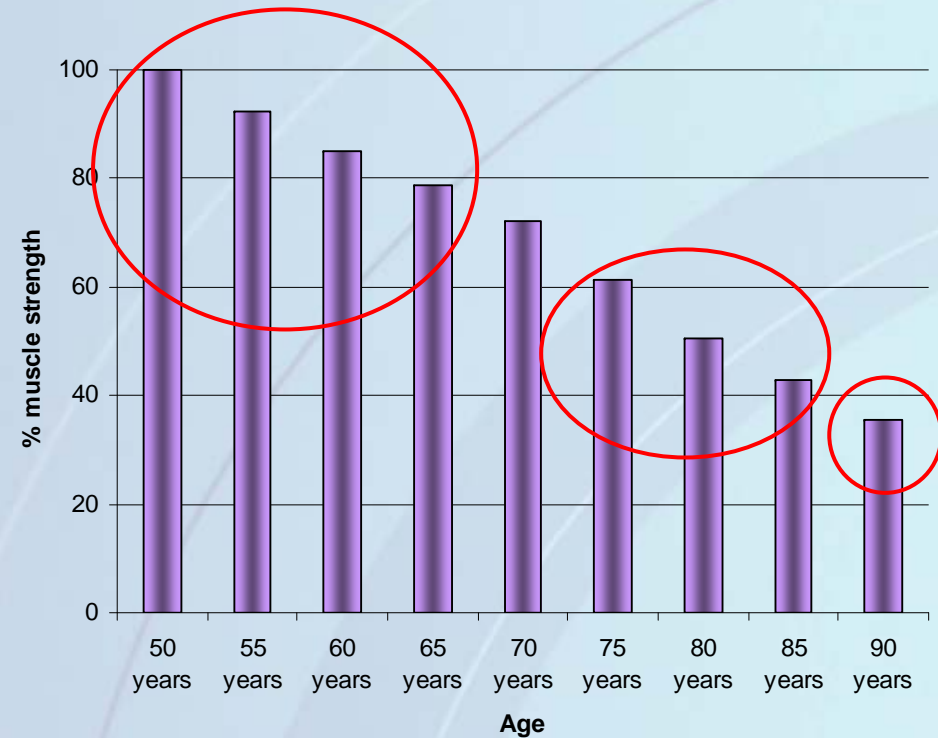
~35% loss of mass by 70yrs

~44% loss of mass by 80yrs

>50% loss of mass by 90yrs

Muscle strength

After 50 years of age: 15% decline per decade
 After 70 years of age: 30% decline per decade



20-25% loss by 50-65yrs

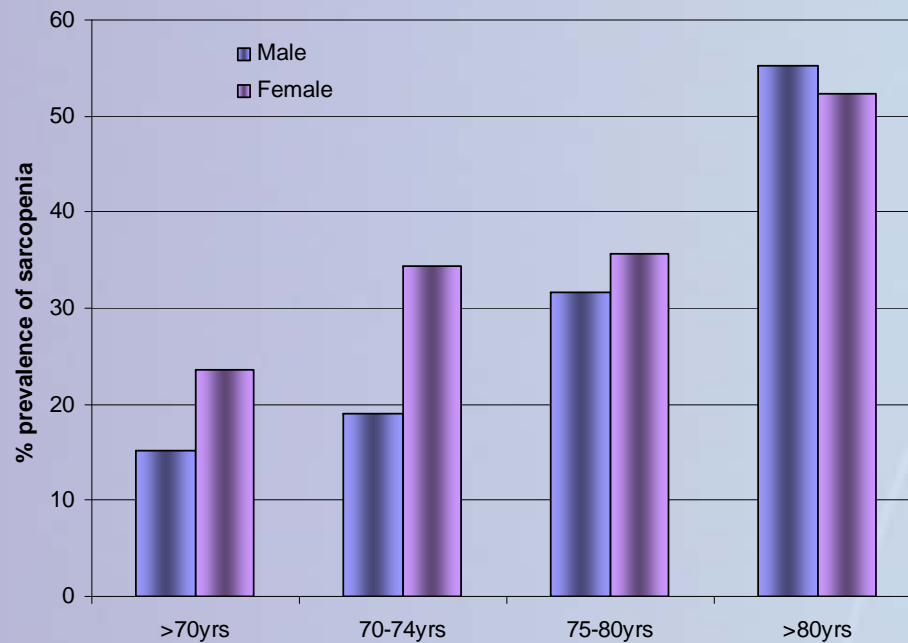
45-50% loss by 75-85yrs

55-60% loss 85+yrs

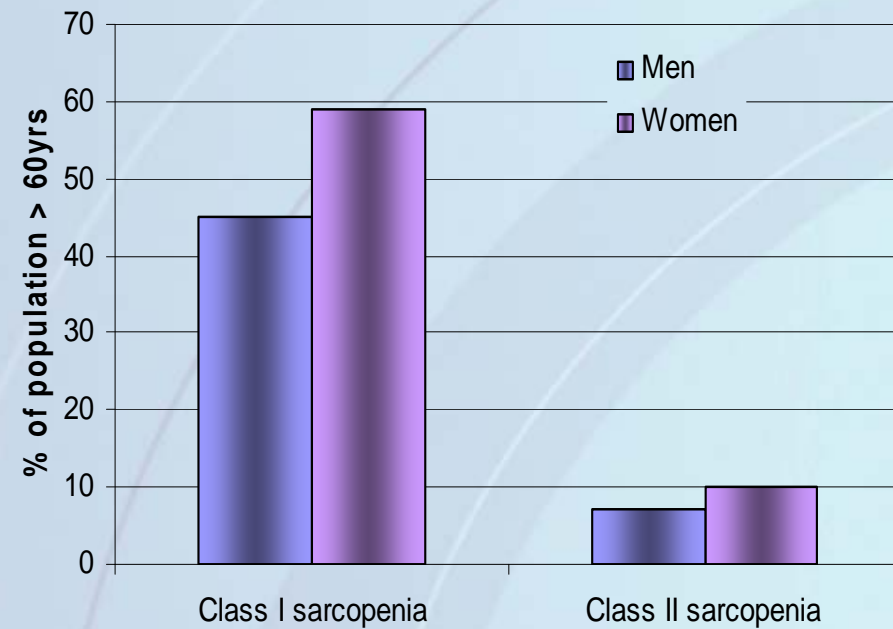
Prevalence of sarcopenia

The prevalence of sarcopenia in the population above the age of 60 years varies between 10 and 60%.

Baumgartner et al., 1998



Janssen et al., 2002



Prevalence of sarcopenia

The prevalence of sarcopenia increases significantly with age, and continues to increase in older populations

Even with a conservative estimate of prevalence, sarcopenia affects >50 million people today and will affect >200 million people in the next 40 years

Consequences of sarcopenia: Impaired ADLs and physical disability

	OR Men	OR Women
≥3 disabilities	3.7	4.1
>1 balance abnormality	3.2	1.8
>1gait abnormality	1.9	1.1
Use of cane / walker	2.3	1.8

OR = Odds Ratio

Sarcopenia is associated with a 3-4 fold increase in the risk of physical disability



Data from the Framingham Disability Study showed that older subjects are less able to perform everyday activities without difficulties

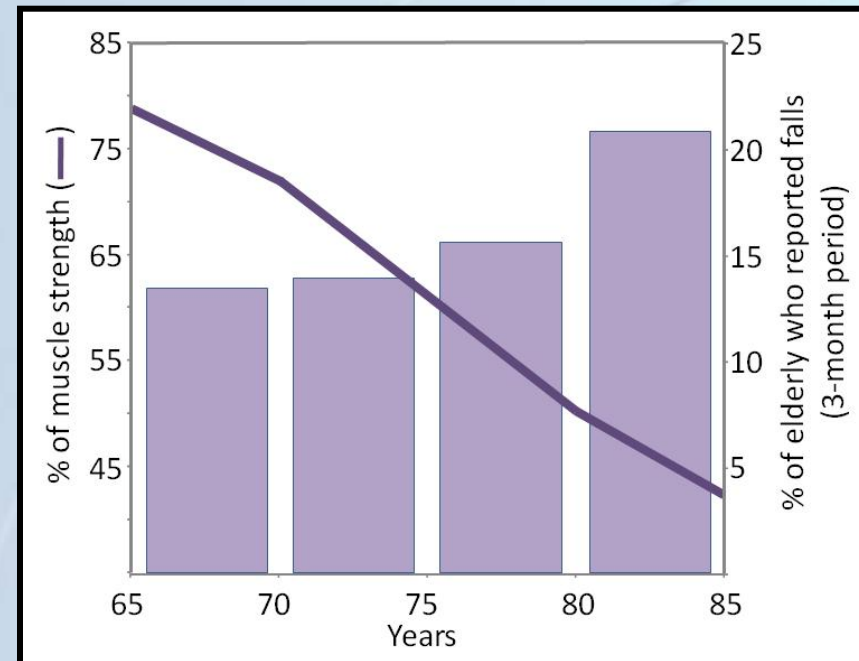
Consequences of sarcopenia: Risk of falls and fractures

Risk factors for falls

Falls risk factor	Mean RR/OR
Muscle weakness	4.4
History of falls	3.0
Gait deficit	2.9
Balance deficit	2.9
Use of assisted devices	2.6
Visual deficit	2.5
Arthritis	2.4
Impaired ADLs	2.3
Depression	2.2
Cognitive impairment	1.8

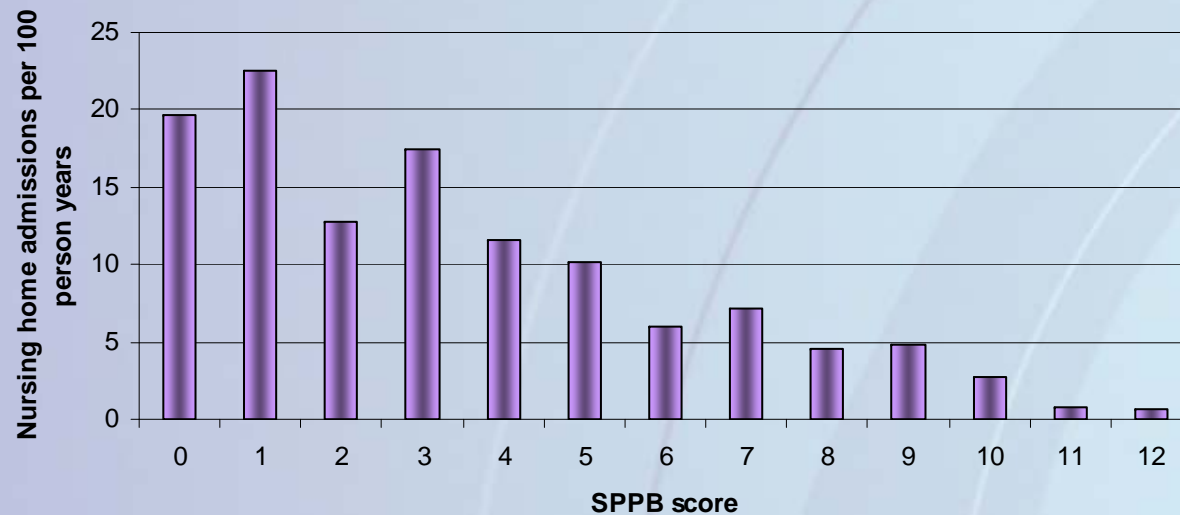
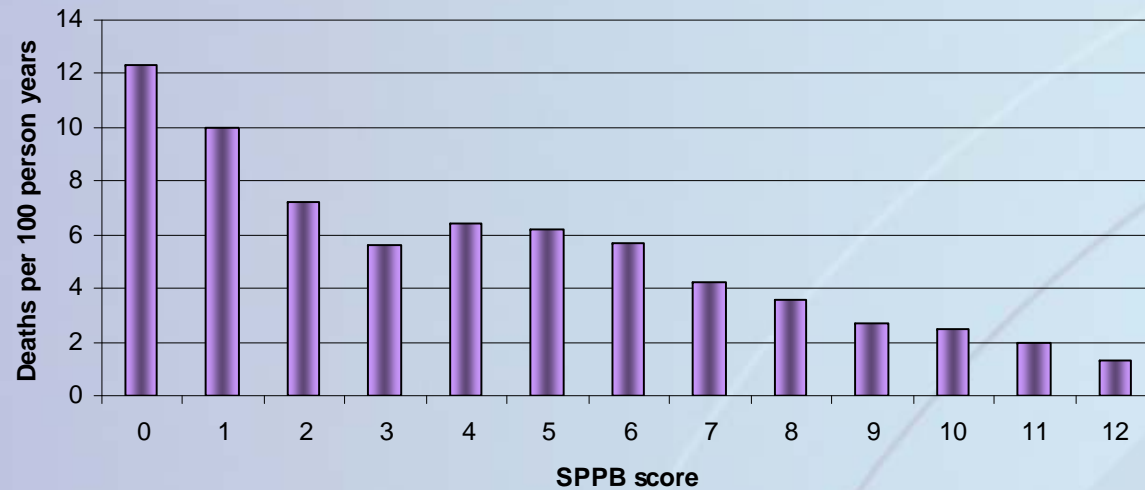
OR = Odds Ratio; RR = Relative Risk

Muscle strength declines as falls increase



Consequences of sarcopenia: Increased mortality and institutionalisation

Physical performance is related to mortality
and nursing home admissions



Higher SPPB score =
better performance

Consequences of sarcopenia: Financial implications

Sarcopenia increases the risk of disability, use of healthcare resources and institutionalisation, therefore the economic burden is great

Annual burden to the USA = \$18.5billion direct healthcare costs
- osteoporotic fractures = \$16.3billion

1.5% of total direct healthcare costs that year

A 10% reduction in sarcopenia prevalence would save \$1.1billion per year

As the number of older persons is increasing the economic burden of sarcopenia will continue to rise unless effective reduction of prevalence occurs

Management of sarcopenia

"To prolong longevity is not a worthy goal of gerontology.

To reduce the detrimental effects of aging is very much a worthwhile goal."

Dr Nathan W. Shock, 1980



"Considerable evidence suggests that sarcopenia is a reversible cause of disability and could benefit from intervention, especially at the early stage of sarcopenia"

Prof Yves Rolland. et al., 2008



Management of sarcopenia: Physical activity

Physical exercise should be recommended for
all sarcopenic patients

Recommendation

The American College of Sports Medicine
The American Heart Association
(Nelson et al., 2007)

Resistance exercise
8 – 10 exercises (using the major muscle groups)
10 – 15 repetitions
Performed at 70-90% of one maximum repetition
On 2 non-consecutive days per week

Society for Sarcopenia, Cachexia and
Wasting Disease
(Morley et al., 2010)

Combination of resistance and aerobic exercise
20-30 minutes exercise
3 times per week

Visvanathan and Chapman
(2010)

Combination of resistance and aerobic exercise
Minimum 50% resistance exercise
30-45 minutes exercise
3-5 times per week

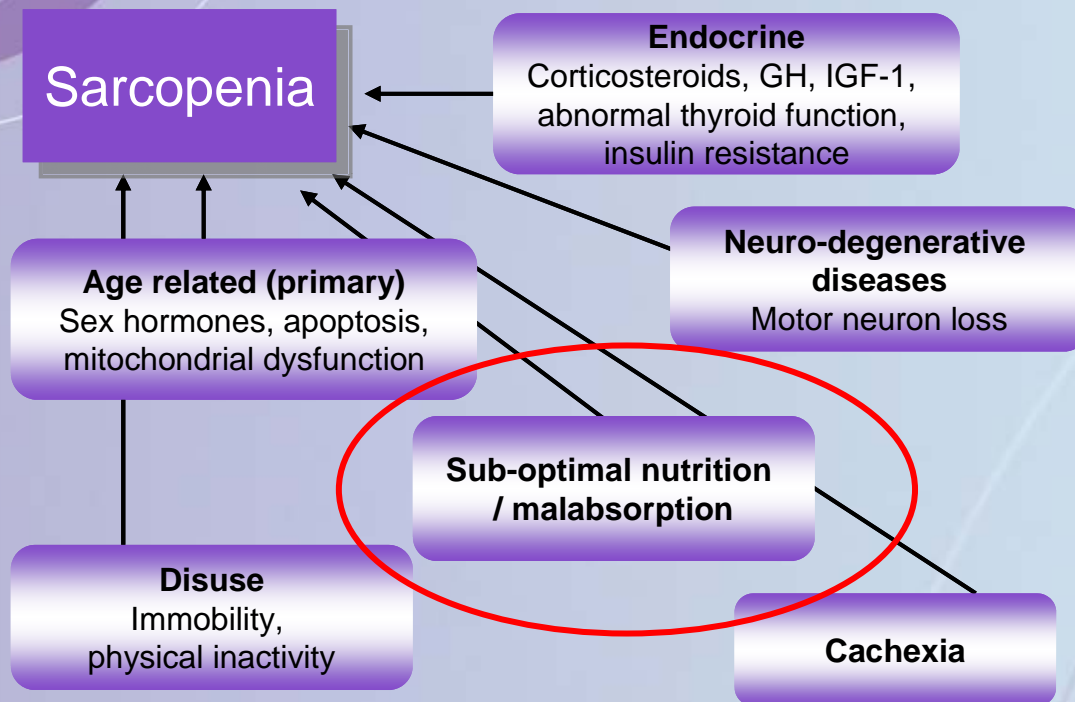
Management of sarcopenia: Physical activity

Physical exercise should be recommended for
all sarcopenic patients

However:

- Exercise programs need to be relevant, effective, safe and realistic for the frail elderly population they are targeted towards
- Organizing resistance training sessions in the elderly is challenging
- Some practitioners are reluctant to prescribe high intensity exercise in elderly subjects
- Participation in regular exercise programs requires motivation from the individual which may be difficult for some older subjects
- Therefore non-exercise interventions may offer a useful alternative

Management of sarcopenia: Nutritional management

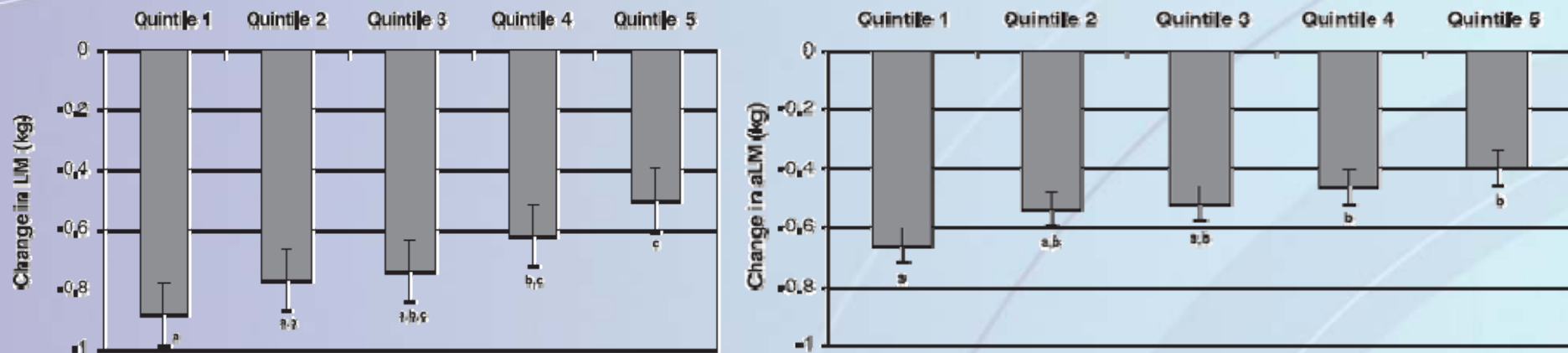


Contributory factors related to nutrition

- Inadequate protein intake
- Increased splanchnic extraction of amino acids
- Decreased muscle response to anabolic stimuli
- Vitamin D deficiency

Nutritional management of sarcopenia: Protein intake

- Health ABC study:
 - Subjects in the highest quintile of protein intake lost ~40% less LM and aLM than those in the lowest quartile over 3 years



- Those in the lowest quartile of protein intake have a 2 fold higher risk of frailty

Nutritional management of sarcopenia: Protein intake

- RDA of 0.8g/kg/d is inadequate to maintain muscle mass and function in the elderly (>65yrs)

Results in a decrease in muscle area

- The elderly have high protein requirements to maintain muscle mass and function
- The elderly have low protein intake
- A protein intake of 1.0-1.5g/kg/d is recommended in sarcopenic subjects

protein

- ~50% consume less than 1g/kg/d

Nutritional management of sarcopenia: Essential Amino Acids

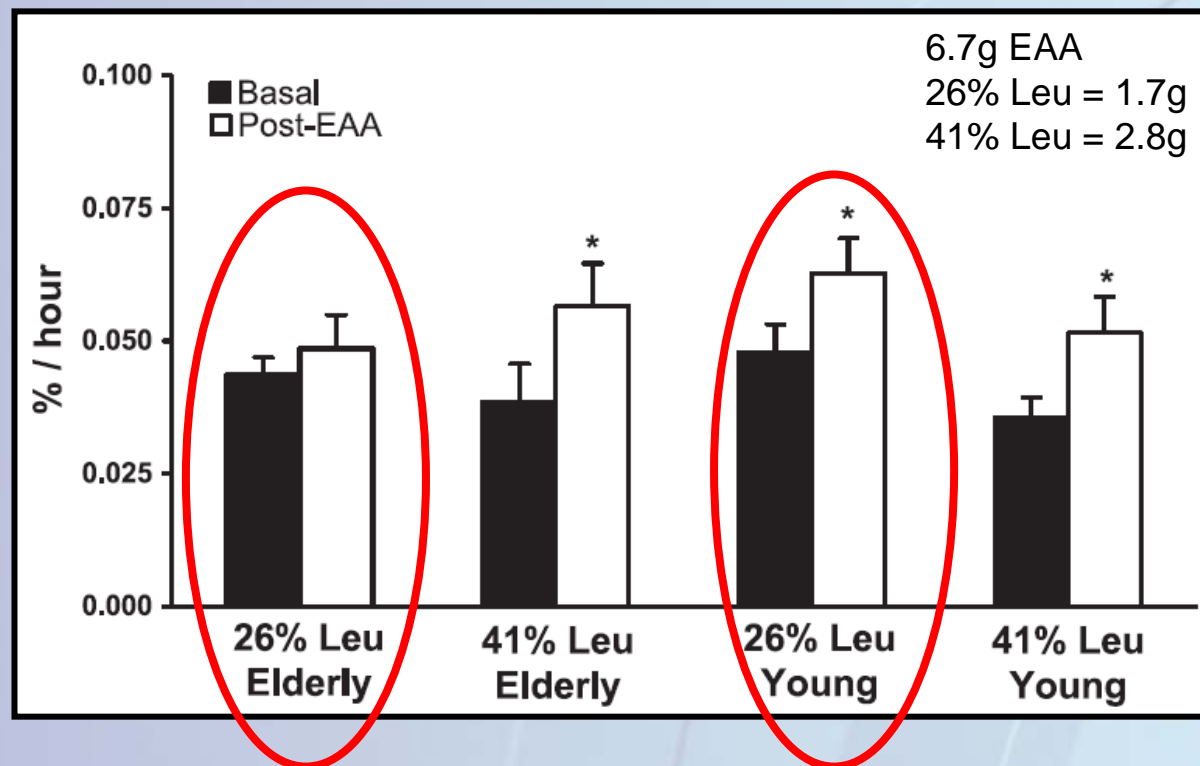
- The availability of blood AAs is a potent stimulator of muscle protein synthesis
- EAA are primarily responsible
 - The addition of nonessential AA provide no additional effect when supplied alongside EAA
- However splanchnic extraction of (E)AA increases 1.5 – 2 fold with aging
- Additionally, the elderly are less responsive to EAA
 - Thus higher EAA doses are required

7g EAA: Stimulates muscle protein synthesis in the young
Does not stimulate muscle protein synthesis in the elderly

15g EAA: Stimulates muscle protein synthesis in the young and elderly

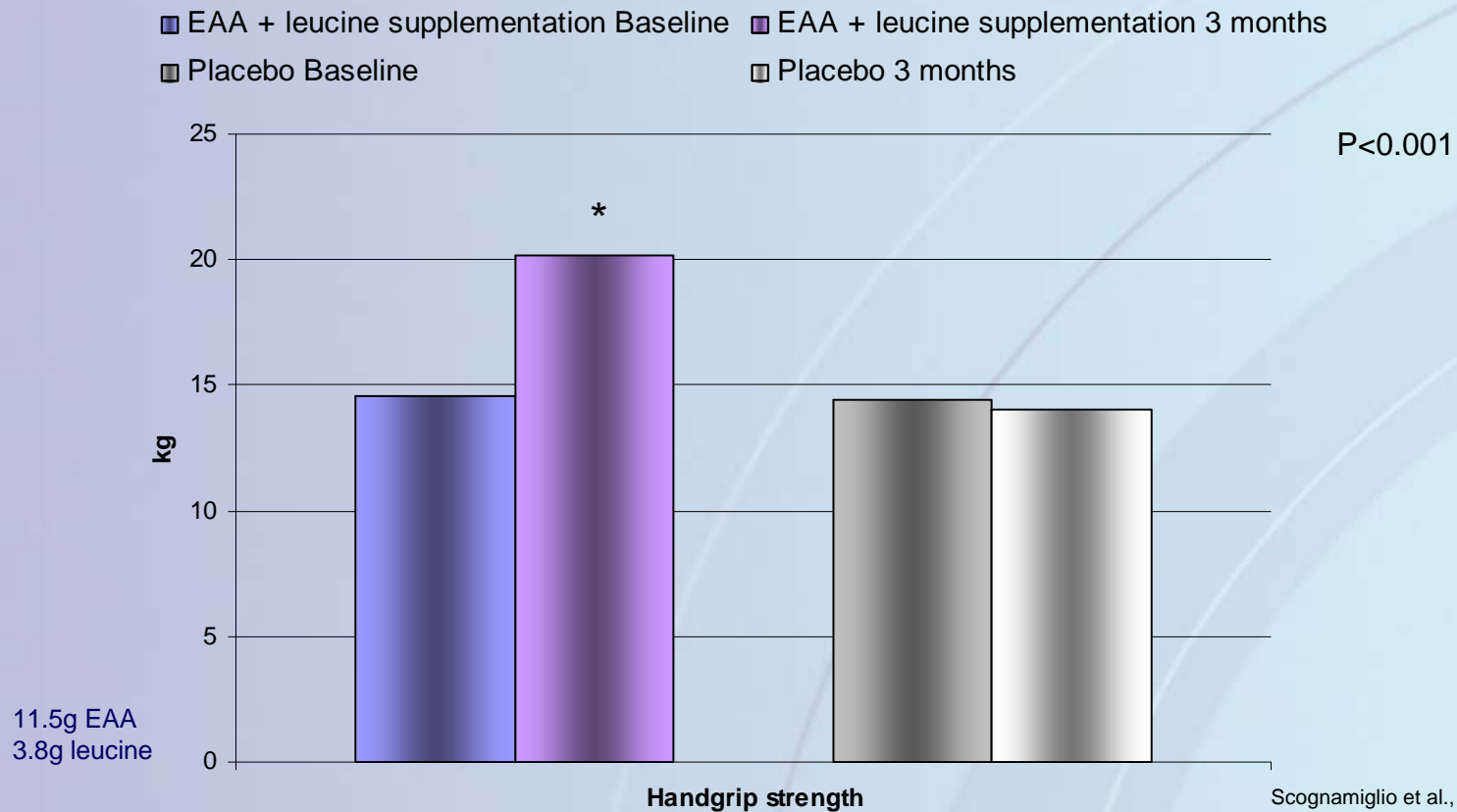
Nutritional management of sarcopenia: Leucine

- Of EAAs, leucine is the most potent stimulator of muscle protein synthesis
- As with EAAs, the elderly are less responsive to the stimulatory effect of leucine



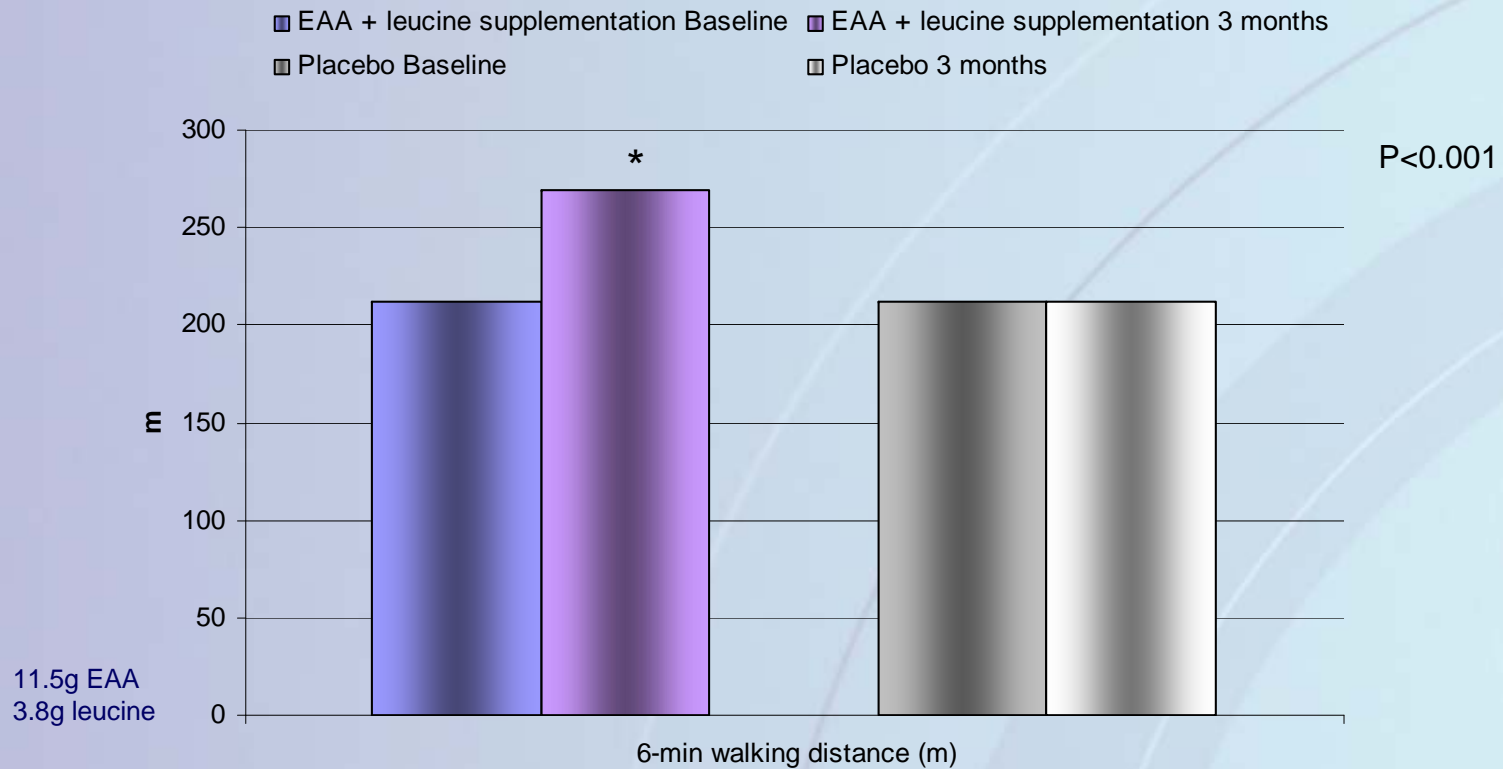
Nutritional management of sarcopenia: Leucine

Supplementation of leucine (with EAA) significantly increases muscle strength and function in the elderly



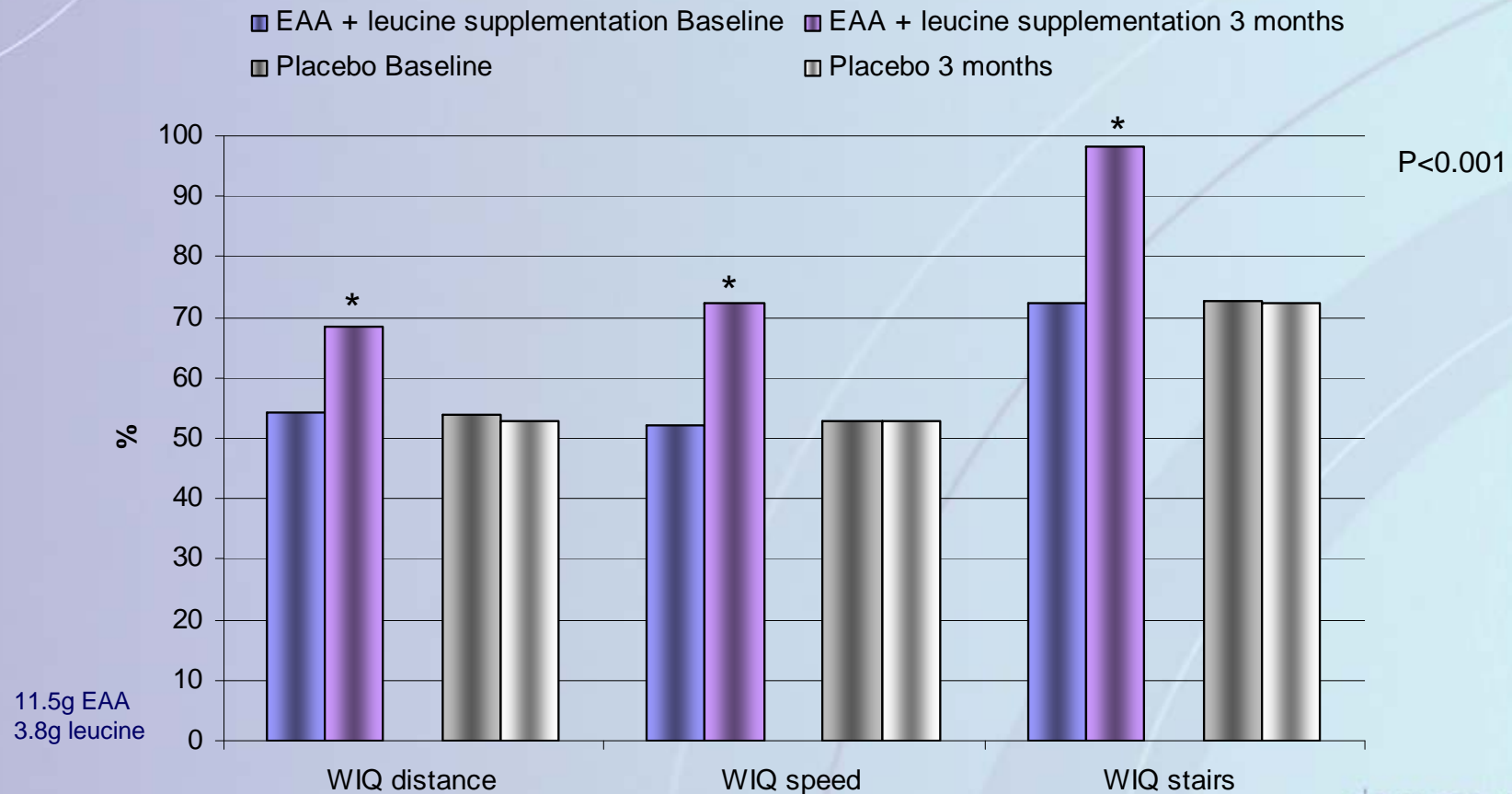
Nutritional management of sarcopenia: Leucine

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Nutritional management of sarcopenia: Leucine

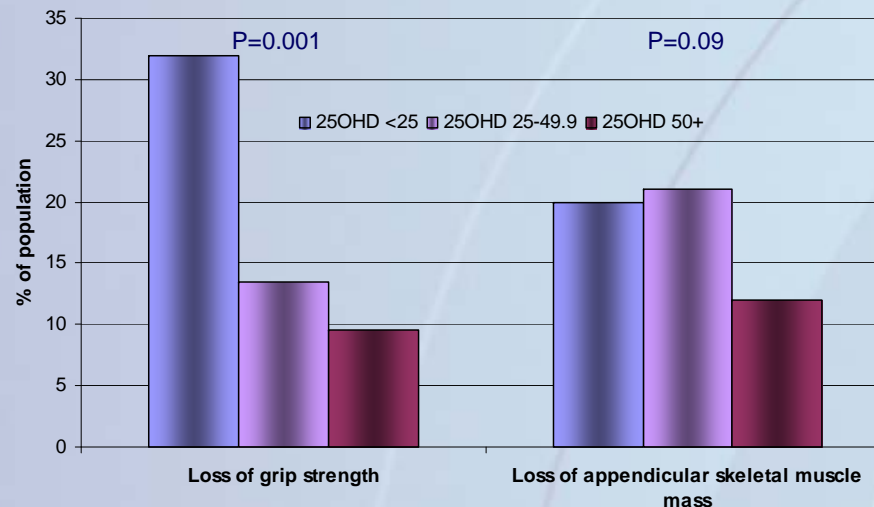
Supplementation of leucine (with EAA) significantly increases muscle strength and function in the elderly



Nutritional management of sarcopenia: Vitamin D

- Low vitamin D levels are associated with:
 - reduced muscle mass and strength
 - gait impairments
 - decreased balance
 - increased risk of falls
 - Long term decline in physical performance
- An independent association between low vitamin D levels and sarcopenia exists

Especially when
25OHD levels are
< 75nmol/l



Nutritional management of sarcopenia: Vitamin D

- 800IU vitamin D supplementation (2-12 months) improves lower extremity strength and function and balance

Meta analysis: Risk of falls

- <700 IU/d: no risk reduction
- 700-1000 IU/d: 19% reduced risk
- 38% reduced risk after 2-5 months
- 17% fall reduction after 12-36 months

Meta analysis: Risk of fracture

- <400 IU/d: no risk reduction
- 482-770 IU/d reduces non-vertebral fractures by 20%
- 482-770 IU/d reduces hip fractures by 18%
- 400-800IU/d sufficient to reduce fractures in elderly

Nutritional management of sarcopenia: Summary

Contributory factors related to nutrition

- Inadequate protein intake
- Increased splanchnic extraction of amino acids
- Decreased muscle response to anabolic stimuli
- Vitamin D deficiency

Nutritional management strategies

- Increase protein intake (1-1.5g/kg)
- Consume high quality or “fast” proteins. AA supplementation
- Increase EAA, in particular leucine, intake
- Increase Vit D intake

Nutritional management of sarcopenia: Guidelines

The Society for Sarcopenia, Cachexia and Wasting Disease published nutritional recommendations for sarcopenia in 2010

Recommendations for the nutritional management of sarcopenia

- This suggests that a **balanced protein and energy supplement may be useful in preventing and reversing sarcopenia** as part of a multimodal therapeutic approach. (A)
- As 15% to 38% of older men and 27% to 41% of older women ingest less than the recommended daily allowance for protein it is suggested that **protein intake be increased**. (B)
- It is recommended that the **total protein intake should be 1 to 1.5 g/kg/day**. (B)
- It is suggested that a **leucine-enriched balanced essential amino acid mix** may be added to the diet. (B)
- Creatine may enhance the effects of exercise in sarcopenic patients. (A)
- Based on treatment trials in patients with sarcopenia and on well-established human physiology, patients receiving anabolic therapies will have increased dietary energy needs to support increases in lean body mass. Whether the increase in dietary energy needs will require **explicit nutritional support is an individualized decision**. (B)
- Based on some treatment trials in patients with sarcopenia and on physiologic hypotheses, for optimal deposition of muscle mass, patients receiving anabolic therapies probably require adequate protein intake. Whether meeting dietary protein needs will require **explicit nutritional support is an individualized decision**. (B)
- 25(OH) **vitamin D levels should be measured** in all sarcopenic patients. (A)
- **Vitamin D supplementation** in doses sufficient to raise levels above 100 nmol/L should be given as an adjunctive therapy. (A)

Concluding remarks

- Sarcopenia is the age related decline in muscle mass, strength and function
- Sarcopenia is highly prevalent in the elderly
- The prevalence of sarcopenia will continue to grow significantly in an aging population
- Sarcopenia is associated with significant clinical consequences,
 - Physical disabilities, an increased risk of falls and fractures and loss of independence with an increased risk for institutionalisation and long term care
- Sarcopenia significantly impacts health care costs
- Current evidence suggests that physical exercise and nutritional therapy are key to managing and reducing the risk of sarcopenia
- Physical exercise is effective in managing sarcopenia, but challenging to implement
- Nutritional support can play a key role in the management of sarcopenia
 - In particular increasing protein intake, the use of EAA / leucine and vitamin D supplementation



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